SNOW AND ITS VALUE TO THE FARMER

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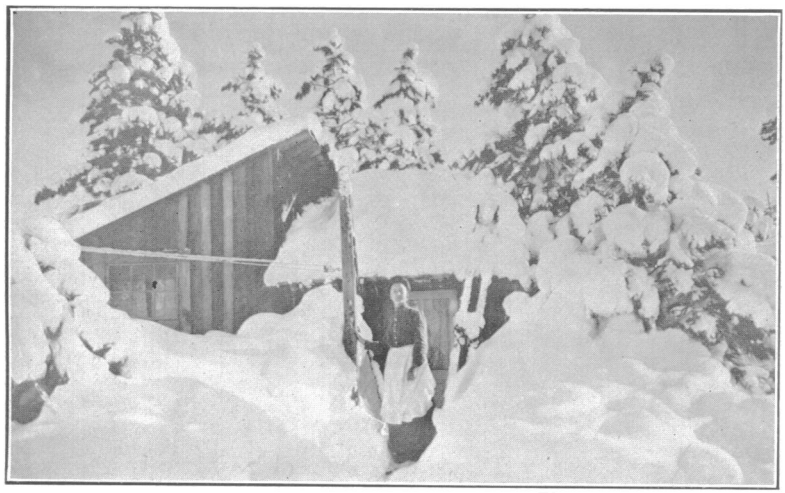
SNOW falls everywhere in the United States except in certain portions of Florida and California. The amount which falls each winter varies greatly in different parts of the country. It ranges from little or none along the coast of the Gulf of Mexico to more than 500 inches in the high Sierra Nevada Mountains. In the more densely settled eastern portions of the United States it ranges from 10 to 50 inches, and measurable amounts fall on from 10 to 50 days of the winter half-year. Here the proportion of the total annual precipitation (rain, snow, hail, sleet, and dew) which occurs in the form of snow ranges from 10 per cent. along the Atlantic coast to 20 per cent. in the vicinity of the Great Lakes. The amount of snow which falls at any particular place also differs from year to year. Some winters are almost free from snow, while others bring abundant snowfall. In the elevated portions of the West, nearly all the precipitation occurs in the form of snow, partly because the summer half-year is comparatively a dry season, and partly because of altitude above sea level. The principal controls which determine the amount of snowfall at any place are the winter temperatures and the amount of moisture in the air.

Snow as it falls averages about 10 per cent. water by volume. In other words, 10 inches of newly fallen snow are usually equivalent to 1 inch of rain. An inch of rain simply means the rain contained in a layer of water 1 inch deep uniformly distributed over the ground. This is equal to a little more than 100 tons of water to the acre. However, falling snow varies greatly as to density, "wet snow" containing relatively more water than "dry snow." Immediately after reaching the ground snow begins to settle, and in the course of time its density is increased to three or four tenths that of water. That which has been subjected to alternate freezing and thawing, or that which has been compressed by the weight of overlying snow often approaches the consistency of ice. The settling pro-

A COTTAGE IN THE SNOW.

ceeds regardless of whether the air temperature is above or below freezing (32° F.). When the temperature is below freezing, gravity alone causes the snow stratum to become more compact, without loss of its crystalline structure. When the temperature is above freezing, melting begins at the surface of the snow, the resulting water percolating through the underlying snow to the ground beneath. There is usually a lag in time between the beginning of melting and the first run-off.

Under conditions favorable for plant growth the moisture contained in a soil of uniform texture is about 25 per cent. of the volume of the soil, broadly speaking. But the maximum capacity of such soil for water ranges from 30 to 50 per cent.



Photograph by Fred Rath.

A COTTAGE SHROUDED IN A MANTLE OF WHITE. To most people snow suggests extreme cold. However, the woman here shown does not appear to suffer from cold, in spite of the frigid environment.

Photograph by Fred Rath.

JANUARY IS A MONTH OF RARE DELIGHT ON THE FARM.

of its volume. Though they show little uniformity in texture or in water content, most soils, under ordinary conditions, can absorb additional moisture. When snow falls upon unfrozen ground it may keep the surface soil from freezing. The snow cover checks the loss of heat through radiation, while some heat is received from below. If such a cover persists throughout the winter the soil may remain unfrozen, and, if so, it will readily absorb water when the spring thaws set in. When an unsaturated soil freezes it is relatively porous, and can absorb moisture as unfrozen soil can, but at a slower rate. When snow that has fallen upon frozen soil melts, a larger proportion of the resultant water is lost through run-off than occurs following the melting of snow lying on unfrozen ground.

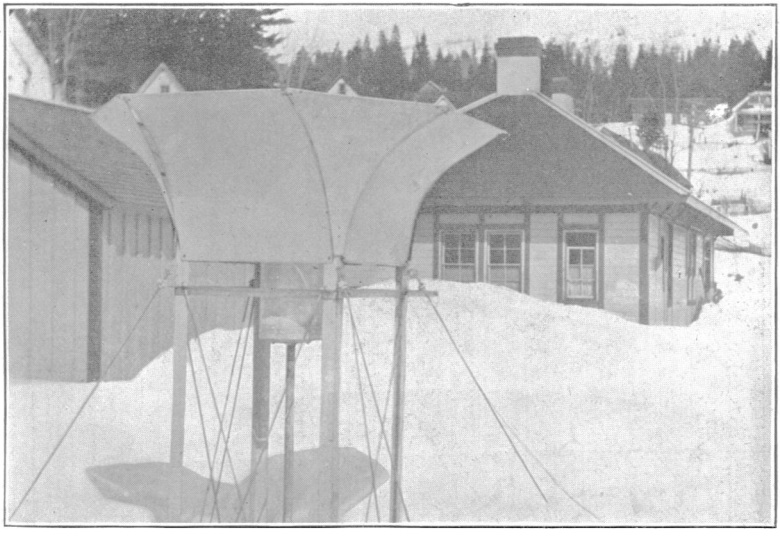
Though the root systems of most annual crops are limited to the first foot of soil, the underlying three feet serve as a reservoir from which they derive much of their sustenance. It has long been recognized that water is wealth, and that the water supply of a country is an important part of its agricultural capital. In one sense this part of the capital is administered

through the first four feet of soil and subsoil, where water moves freely in capillary action. Snow conserves as well as replenishes this soil moisture during the winter season.

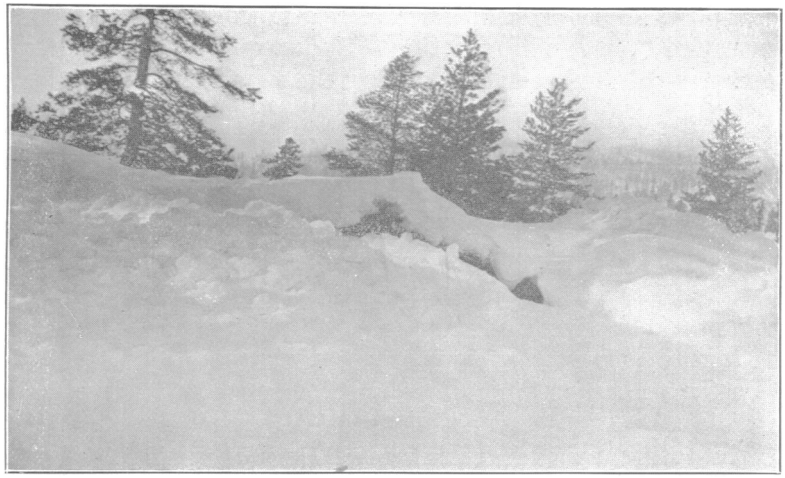
The Significance of Snow to the Farmer

In cities, snow probably does more harm than good. It makes walking difficult, delays transportation, and interferes with wire communication. In great cities like New York, Chicago and Boston the cost of removing snow from the streets amounts to hundreds of thousands of dollars every winter. To the farmer, however, snow is an asset, not a liability. Although it does make roads impassable until "broken in," and although in the plains of the West a heavy fall of snow temporarily cuts off the food supply of grazing cattle, snow may rightly be considered an agricultural resource. "A snow year, a rich year," says one proverb. An enumeration of some of the more important factors showing the great value of snow to the farmer follows.

As a protective covering or blanket, snow serves very much like leaves or straw, only in a lesser degree. Frost in the ground is simply capillary moisture which has been congealed by temperatures below freezing. Frost will penetrate to a greater depth in newly plowed land than in a pasture. For the



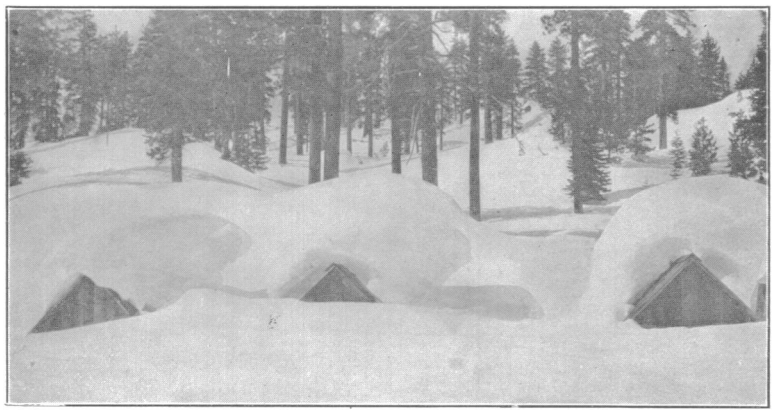
The Marvin Shielded Rain and Snow Gage, used by the U. S. Weather Bureau to Measure Snowfall. The curved plates forming the sides eliminate the effects of wind currents, thus permitting a true "catch" of snow in the enclosed cylinder.



Photograph by Fred Rath.

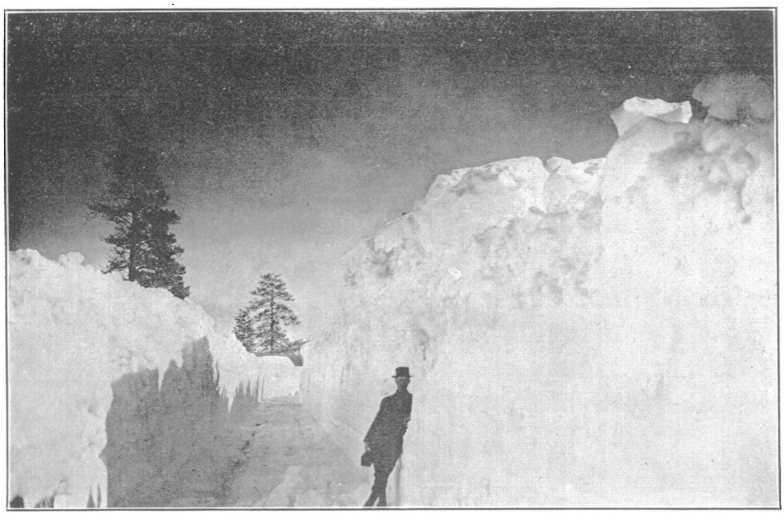
ABANDONED TO WINTER—A COTTAGE SUBMERGED IN SNOW. When deep snow like that here shown melts, much of the water soaks into the ground.

same reason it will penetrate deeper in bare than in snow-covered ground. The protection afforded by the snow results partly from the snow forming the covering and partly from the air associated with it. Experiments have shown that a 2-inch covering of snow will reduce the daily heat exchange between the earth and the air above it almost one third, and that a 4-inch covering will reduce it about two thirds. For example, in an investigation which extended over a period of about eight days, during which the extreme range of the air temperature amounted to 34°, a thermometer 2 inches beneath the surface of the snow showed a range of 25°, one at 4 inches a range of 14°,



COTTAGES ALMOST SUBMERGED IN SNOW.

one at 8 inches a range of 3°, and one at 12 inches a range of but 1°. No range in temperature was observed at the bottom of a 24-inch cover of snow. Moreover, there was a distinct lag in the time of maximum and minimum temperature as the depth of the snow cover increased. It was found that it took 12 hours for the cold to penetrate the 12-inch cover, causing the lowest temperature to occur there at the time of the highest temperature in the open air, and *vice versa*. The diurnal heat exchange in deep snow on the ground is only about one half that in a grass-covered meadow, and about one fourth that in bare sandy soil. Furthermore, it is twice as much on clear as on cloudy days. The denser the snow the poorer it is as a pro-



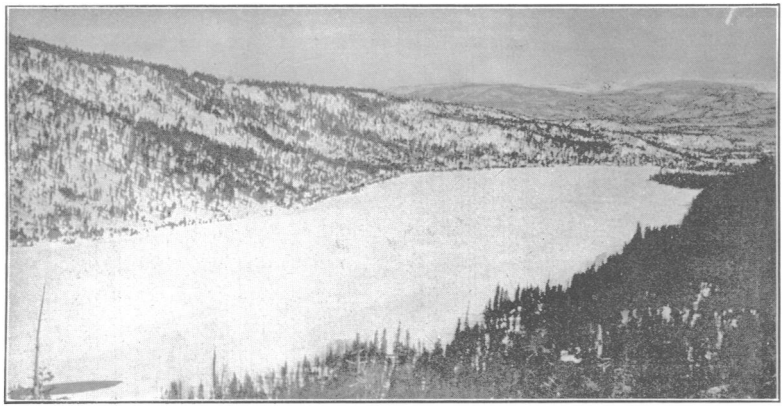
Photograph by Fred Rath.

THIS PICTURE, TAKEN IN THE MOUNTAINS OF CALIFORNIA, SHOWS SNOW WHICH UNON MELTING WILL FURNISH IRRIGATION WATER FOR THE FERTILE VALLEYS FOR WHICH THE STATE IS FAMOUS.

tector. Loosely packed snow containing much air mixed with it serves as the best blanket. Besides being a poorer conductor of heat, and therefore a better protector than ice, loose snow permits the respiration of submerged vegetation, which proceeds even at temperatures far below that at which actual growth is possible. Grass and grain are sometimes smothered when the snow, through alternate thawing and freezing, is converted into ice.

Besides serving as a blanket which checks the loss of heat from the ground either through conduction or radiation, a cov-

ering of snow prevents evaporation from the soil. Soil moisture, conserved and replenished by the snow, is thus made available to the roots of trees and perennial plants during the cold season, when little rain falls. Moreover, such a cover prevents the violent winter winds from tearing the dormant vegetation. Furthermore, snow permits the penetration of some light, and recently it has been recognized that light can replace heat to a considerable extent in the various processes of vegetation. Again, it is known that killing from cold is due to the removal of water from the plant protoplasm, the freezing be-



LAKE SPAULDING, AN ARTIFICIAL RESERVOIR IN THE HIGH SIERRA NEVADA MOUNTAINS OF CALIFORNIA. Water from melting snow collects in this reservoir and is subsequently used for irrigation and power purposes.

ing largely intercellular. A plant's ability to withstand cold depends in large measure upon the capacity of its cells to give up water without injury. In most kinds of vegetation, and particularly in winter buds and woods, a rapid fall in temperature requires that water be given up faster than the plant cells can afford to lose it, the result being serious injury or death. As a means of checking this rapid decline of temperature, either in snow-covered branches of trees or in snow-covered vegetation on the ground, another value of snow is easily recognized.

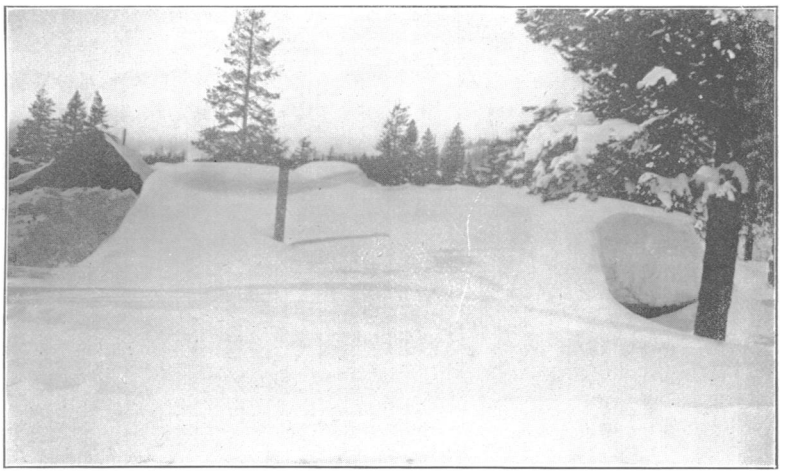
Snow has aptly been called "the poor man's manure." The reason is obvious. Melting snow moistens the soil gently and gradually without condensing particles by pounding them and without floating up any clayey mud to the surface to encrust the land when it dries. Rain compacts the surface soil, but snow and frost loosen it. Alternate freezing and thawing mellows the soil. When water freezes it expands. The expansive force is

SNOWBOUND.

very great; it is sufficiently powerful to break up and to crumble solid matter with which it is associated. This is the reason why coarse lumps or clods of soil fall apart in the spring. For the same reason marl strewn over the surface of the ground in the autumn becomes a powder before spring.

Snow also checks the run-off when the temperature is low. Ground water is replenished more easily by the melting of snow, or by rain falling on the snow, than it is when an equal amount of rain falls upon bare ground. Moreover, the bene-

HOUSE IN THE SNOW.

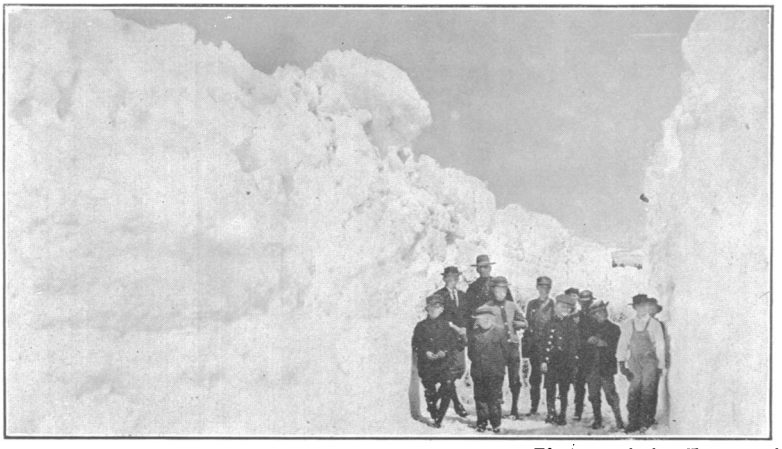


Photograph by Fred Rath.

ONLY THE CHIMNEY OF THIS COTTAGE CAN BE SEEN, THE REMAINDER BEING SUBMERGED IN SNOW.

ficial effects persist longer. Snow is not melted by cold rain as readily as most people imagine. Dry winds, direct sunshine, and high air temperatures are much more effective.

As a source of moisture snow is perhaps less important than rain, generally speaking. However, in the western portions of the United States the winter snows furnish practically all the water used for irrigation and power purposes throughout the year. Fortunately, the snowfall in the western moun-



Photograph by Fred Rath.

A RAILROAD CANYON IN A REGION OF EXCESSIVE SNOWFALL.

tains is abundant. Packed by compression, as well as by alternate freezing and thawing, great banks and drifts of snow solidify to ice. Slow melting follows in the spring and summer, the resulting water collecting in natural and artificial reservoirs to form the only available summer supply.

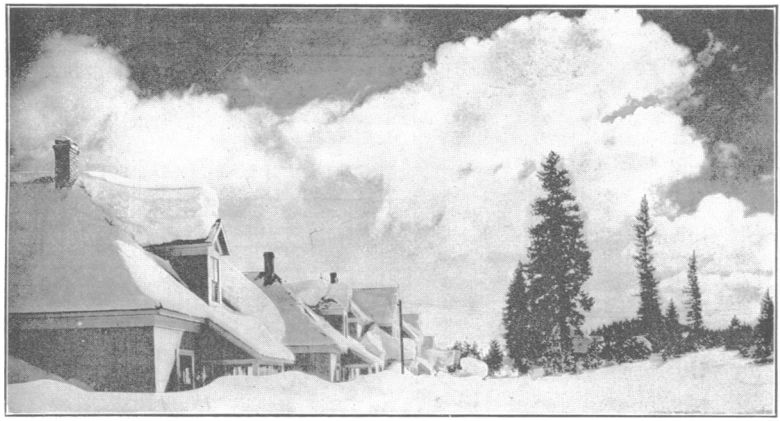
In various other ways snow is valuable. Just as transportation by water involves less waste of energy than by rail, so it is easier by sled than by wagon. There is smaller loss of energy due to friction and to wear and tear. Logging and lumbering, as well as the transportation of bulky and weighty quantities of grain, wood, coal and ice, could not be accomplished easily without the snow. A snow cover prevents the occurrence of prairie fires. Forest fires are least likely in midwinter, for the same reason. They usually occur during the spring, summer and autumn months, when vegetation is dry, and there is little to check the spread of a fire once started. Moreover, snowflakes remove certain microbes (disease germs) and dust particles from the air through which they fall. For this reason water derived from the melting of snow which has fallen in or near cities is not fit for drinking purposes.

Photograph by Fred Rath.

BRANCHES OF TREES HEAVILY LADEN WITH SNOW. (Note the railroad snowsheds in the background.)

SNOW AND GRASS.

Every farmer has observed that a good hay crop follows a winter of abundant snow. After such a winter the subsoil is



Photograph by Fred Rath.

MIDWINTER IN A WESTERN MOUNTAIN VILLAGE.

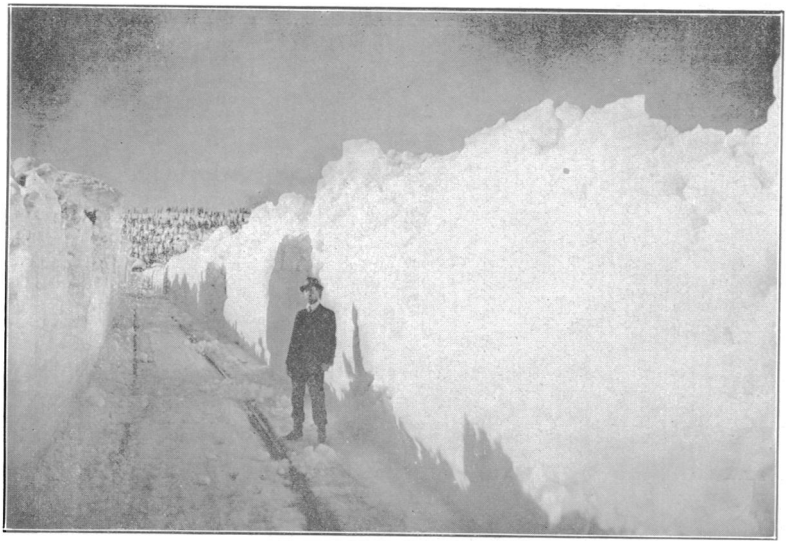
almost saturated. Moreover, grass is easily injured by alternate freezing and thawing of the soil moisture enclosing its roots, but is greatly benefited by a snow cover which persists throughout the winter. In the expansion which accompanies the freezing of moisture in the surface soil the grass roots are torn and heaved out. For this reason pastures are soft in the spring. Lawns and pastures are improved by spring rolling, which presses the roots back into the soil, forming a firm sward. Loosely packed snow is an ideal winter cover for all kinds of grasses. However, if the snow is solidified to ice by frequent winter thaws and subsequent freezing, the roots may be smothered.

SNOW AND WINTER WHEAT.

The beneficial effect of snow is perhaps more readily apparent in the case of winter wheat than in any other crop. Wheat is normally a winter annual, and climate is its most important control. It requires a temperature of about 40° F. to germinate, and while it does not grow at a lower temperature, the plants inhale oxygen and exhale carbonic-acid gas throughout the winter. Cool weather and considerable moisture are required during its early growth. The weather conditions prevailing during the winter months determine its density of growth, and therefore its yield. The plumpness, quality, and color of the grain are determined by the warmer and drier part

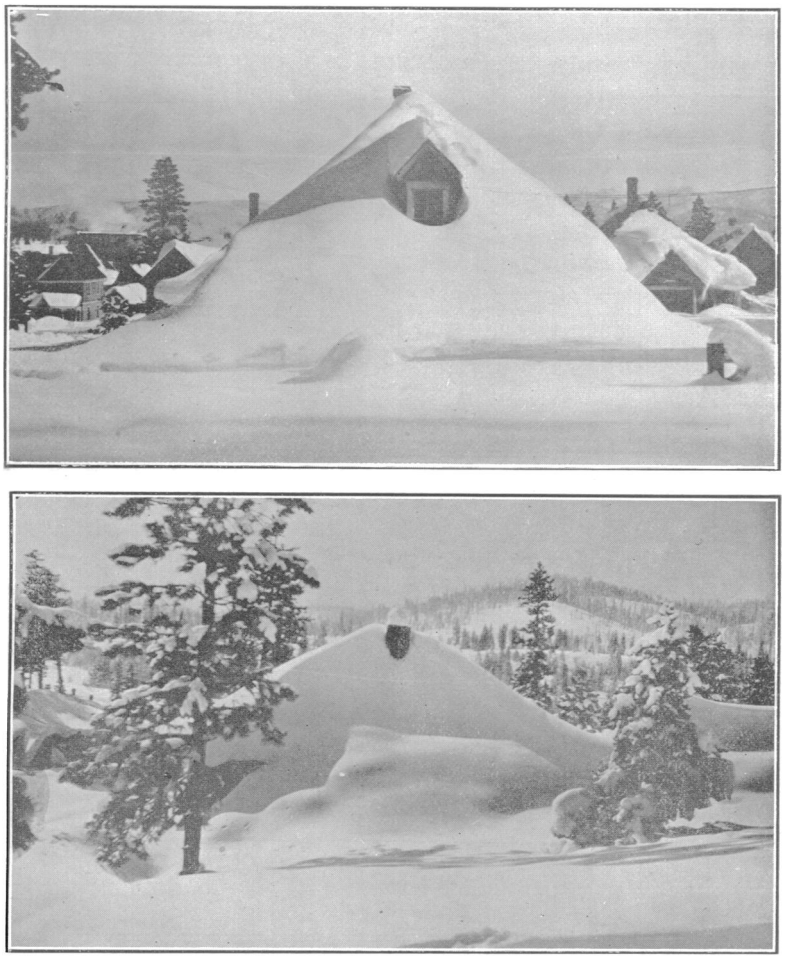
of the year, when the crop ripens. The importance of snow in the early growth of winter wheat is paramount in regions where the winters are severe. Snow acts as a protective cover against temperature extremes, wind and evaporation; it permits the penetration of light and the respiration of the plant tissues; it supplies the necessary winter moisture; and prevents the tearing and the heaving out of the roots by the alternate freezing and thawing of the soil.

More than two thirds of the winter-wheat acreage in the whole United States is included within the eight states of Kansas, Nebraska, Oklahoma, Missouri, Illinois, Indiana, Ohio and Pennsylvania. In this belt the winters, though moderately severe, usually bring sufficient snow to protect the crop. On the other hand, more than five sixths of the spring-wheat acreage of the country is included within the three states of North Dakota, South Dakota and Minnesota. In this belt winter wheat is not produced on a large scale, principally because ordinarily there is insufficient snow to protect such a crop during the severely cold periods which occur almost every winter.



Photograph by Fred Rath.

IN A REGION OF EXCESSIVE SNOWFALL.



Photograph by Fred Rath.

DWELLINGS ENSHROUDED WITH SNOW.

SUMMARY.

To the farmer the benefits derived from snow far outweigh the disadvantages. As it falls, the density of snow is about one tenth that of rain, but upon lying on the ground it soon acquires a density of about three or four tenths that of water. Under certain conditions it may solidify to the consistency of ice. As a blanket or covering, snow on the ground checks winter killing. It protects vegetation from extreme temperatures, from excessive evaporation, and from destructive winds, at the same time permitting the penetration of some sunlight, and

Photograph by Fred Rath.

RAILROADING UNDER DIFFICULTIES IN THE WESTERN MOUNTAINS.

allowing uninterrupted respiration of plant tissue. On twigs and buds it conserves cellular moisture which otherwise might be sacrificed at too rapid a rate during sudden changes of temperature. It mellows the soil, replenishes the ground moisture, checks the run-off from winter rains, furnishes most of the water used for irrigation and power purposes, provides an easy means of transportation, and prevents destructive prairie and forest fires. Grass is benefited by abundant snows, and winter wheat is largely dependent upon it for its success. All in all, the recurring snows of winter form one of our most important agricultural resources.